RESEARCH HIGHLIGHT

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Wall Moisture Problems in Alberta Dwellings

INTRODUCTION

Moisture penetration in walls, from exterior or interior sources, can have significant negative impacts on the durability of housing. A study completed for Canada Mortgage and Housing Corporation (CMHC) in 1996, found that houses in the coastal region of British Columbia (B.C.) were experiencing substantial problems due to water leakage from exterior sources. In 1997, reported water leakage problems caused similar concerns in Alberta.

As a result of the concerns, the Alberta Housing Industry Technical Committee, representing Alberta's residential construction industry, along with CMHC jointly sponsored a study to:

- investigate a representative sample of dwellings with various types of windows and wall claddings;
- draw conclusions on the sources and causes of moisture-related problems through walls and windows in Alberta;
- make recommendations to remedy the problems; and
- recommend changes in construction practices to avoid similar problems in the future.

Additional objectives for the study were to:

- analyse and correlate water entry problems with design and construction features of building envelopes; and
- compare the nature and cause of moisture problems in Alberta with those found in coastal B.C.

RESEARCH PROGRAM

Data was collected for forty-one houses and nine multi-unit buildings located primarily in Calgary and Edmonton. All buildings were ten years old or less.The specific buildings were chosen because they were representative of typical materials and methods used in single family and low-rise multi-family wood frame houses in Alberta including:

- claddings (stucco, vinyl, brick or aluminum siding);
- windows (PVC or aluminum clad wood frames with perimeter nailing flanges or wood with brick moldings);
- sheathing (oriented strand board or untreated exterior grade plywood);
- sheathing membranes (ordinary building paper, spunbonded polyolefin housewrap, or perforated polyethylene sheet housewrap); and
- wall construction methods (140 mm framing with glass fibre batt insulation, poly vapour barrier, and gypsum board air seal).

The selected buildings also were classified as problem (those who have or previously had problems), non-problem (proved to not have problems upon inspection) or unfinished (under construction).

Each building review included data collection and onsite inspections.Worksheets, modelled after the B.C. study, were used to gather information about the general building, wall assembly, wall details, symptoms and failure mechanisms.The onsite research was comprised of a meeting with the building manager, owner or tenant, an inspection of typical moisture-related damage on the interior and a visual inspection of selected exterior locations to determine probable moisture sources and verify construction details.

Informal interviews with building industry representatives were also conducted to gain a better understanding about perceived moisture-related problems.

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RESULTS

The buildings that were reviewed were not a random sampling. The selection was biased toward houses that have more problems overall, compared with the entire Alberta housing population.

Exterior Moisture

Exterior moisture, most often from direct rain penetration, was a contributing factor in 91 per cent of problems. Most problems occurred at window and door perimeters and decks.

Interior Moisture

Condensation moisture, caused by occupants trying to maintain indoor humidity above 30 per cent during the winter, contributed to 14 per cent of all problems.

Responsibility for Problems

Construction and design, especially for stucco clad walls, were the most common factors contributing to problems.

Additional Findings

Stucco-clad buildings had more reported moisture problems, compared to vinyl-clad buildings. Some construction details were disproportionately associated with problem walls including parapets at roof edges, soffits that slope down to a wall, exposed columns, vertical transitions, rail attachments and scuppers.

Moisture-related damage to buildings in the Alberta study was less severe than in the buildings from the B.C. study, due to less rainfall and greater drying potential.

Walls exposed to the north and west prevailing winds were more likely to experience water leakage.

Table 1 Indicators of Problem Categories by Type of Exterior Cladding and Construction Details (number of citations)

	Stucco	Vinyl	Other	Total
Material/Installation Defects—Wall Section	3	0	0	3
Penetration: Poor Seal	3	1	0	4
Poor Base/Transition/Control Joint Flashing	2	1	0	3
Poor Deck or Balcony Waterproofing—At Outer Edge	4	0	1	5
Poor Deck/Walkway/Balcony Waterproofing—At Walls	8	1	0	9
Poor Deck/Walkway/Balcony Waterproofing—Field	2	0	0	2
Poor Drainage/Eavestroughs/Downspouts	4	0	0	4
Poor Other Details	6	0	0	6
Poor Parapet/Guardrail Cap Flashings	4	0	0	4
Poor Roof/Wall Joint Flashings	2	0	0	2
Poor Vents: Interior Moisture	1	1	0	2
Window or Door: Leakage	4	0	0	4
Poor Vents: Exterior Moisture	0	0	0	0
Window or Door: Poor Flashing at Head	14	0	0	14
Window or Door: Poor Still Flashing	13	0	0	13
Window: Poor Seal at Corner Mitre Joints	2	0	0	2
Window: Poor Seal at Frame/Cladding Joints	14	0	0	14
Window: Poor Weather Barrier Installation	14	0	0	14
Total	100	4	1	105

IMPLICATIONS FOR THE HOUSING INDUSTRY

The report contains a full discussion of properties, problems and recommendations for sheathing membranes, stucco and vinyl cladding, flashings, windows, doors, balcony connections, small penetrations, foundations, air leakage and drainage.

The most important point is that walls should be designed and constructed to shed water and drain penetrating moisture to the exterior. Each wall and its exposure must be assessed in relation to the expected conditions. Homes exposed to high wind conditions require upgraded construction practices and materials to prevent costly repairs for moisture-related damage.

Additional implications for:

Sheathing membranes—The sheathing membrane provides a majority of the rain water resistance, particularly with stucco claddings. More water-resistant membranes will not solve the problems and may increase the potential for condensation to be trapped within the wall. Correctly lapped and installed building paper or house wrap will perform adequately for most applications.

Vinyl or stucco cladding—Install cladding and trim to shed and drain moisture to the exterior. Consider using rainscreen systems. Stucco mix proportions, sand impurities and additives to improve the workability, may impair the strength, imperviousness, water repellency or frost resistance of the cured material.

Flashings—Use flashings with significant slope to the exterior, adequate extension beyond the face of the wall to create a proper drip edge, and adequate vertical extension behind the sheathing membrane on the wall (at least 50 mm, for normal exposure and 100 mm for severe exposure.) Install flashings above all penetrations through the wall and at all window sills. Minimize joints in flashings whenever possible.

Windows and doors—Select windows that are designed based on rainscreen principles, including the connections between frames and perimeter seals. Have windows installed by experienced glazing tradespeople rather than framers. Install windows and doors immediately upon delivery to minimize theft and damage. Use installation practices that are appropriate for the specific exposure and window type, focusing on providing an interior air seal, drained rough opening cavity and adequate flashings.

Table 2 Symptoms and Severity of Damage

	Symptoms	Minor	Moderate	Severe
Stucco Clad Walls				
Cladding	stains decay cracking	5	11	1
Sheathing Membrane	rot	0	0	1
Sheathing	stains	0	1	1
Framing	saturation	0	1	1
Interior	stains saturation shrinkage or swelling cracking	18	18	2
Vinyl Clad Walls				
Interior	stains saturation shrinkage or swelling cracking	1	2	0

Balcony connections—Prevent water leakage into the wall below by installing flashings and sheathing membranes. Use manufacturer's recommended details that will allow for the future installation and replacement of decking materials.

Small penetrations—Design flashings and sheathing membrane details for small penetrations similar to those for large openings.

Foundations—Extend sheathing membrane and cladding at least 50 mm below the joint between the floor framing and concrete foundation. Provide a drip flashing to prevent water from draining down the face of the foundation wall.

Air leakage—Ensure that the most air and vapour tight components of the wall are directly to the interior of the insulation. Incorporate material choices and sealing techniques that will eliminate any trapping of moisture within the wall. Continue the air seal to the window and door assembly or other penetration.

The Alberta study demonstrated that although leakage from exterior moisture sources is causing some problems in Alberta dwellings, there are specific improvements that can be made by the housing industry to decrease moisture leakage and the resulting problems.

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Housing Research at CMHC

Under Part IX of the ***National Housing Act***, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research.

This fact sheet is one of a series intended to inform you of the nature and scope of CMHC's research.

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